NASA TECH BRIEF

Marshall Space Flight Center

Radiation View Factor Program

The problem:

To develop a program which would calculate radiation view factors between any system of surfaces.

The solution:

A computer program, RAVFAC, which represents a new technique for calculating diffuse radiation view factors, using contour integrals. The technique is combined with the finite difference (double summation) technique to compose the total program package.

How it's done:

The two techniques indicated for calculating radiation view factors were included in this program because the contour integral offers greater accuracy and the finite difference offers faster run times.

The program also includes a method which accounts for the effects of shading by other surfaces. There is a routine which reduces run time by eliminating surfaces that cannot cause shading on the areas for which the view factors are being calculated.

The program has the capability to (a) calculate the diffuse radiation view factor using either or both of the techniques mentioned, (b) calculate the effects of surface shading, (c) normalize the radiation view factors, (d) analyze any of seven surface types (rectangular plate, circular plate, trapezoid, cylinder, cone, sphere, paraboloid), (e) use up to 150 different surfaces on each case, (f) divide the surfaces into nodes for which view factors are given, (g) use up to 2500 elements for each case to improve accuracy, (h) select surfaces which are to be included in the shading effects by using "shading flags," (i) restart after computer failure or termination as a result of maximum run time or machine failure, (j) use check-out options, and (k) use three coordinate systems. No other program is known to have this combination of capabilities.

Notes:

1. The RAVFAC program can be used to calculate radiation view factors between any system of surfaces; i.e., it is not restricted to aerospace use only. It could be a useful tool in any engineering discipline where thermal radiation must be considered.

2. At present, view factor calculations are based on approximating the element with a rectangular plate. Work was done on solving the contour integral equation for the various surface types. These equations can be included in RAVFAC to provide more accurate view factor equations. Another benefit of these equations is that the view factor can be calculated on a node-to-node basis, instead of element-to-element, or if the two nodes are not shaded. This reduces run time.

3. The program is written in FORTRAN V for use on the UNIVAC-1108 computer.

4. Inquiries concerning this innovation may be directed to:
   COSMIC
   Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10106

Patent status:

No patent action is contemplated by NASA.

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